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RAT PROOFING.

ITS PRACTICAL APPLICATION IN THE CONSTRUCTION OR REPAIR OF DWELLINGS OR OTHER BUILDINGS.

By FRIENCH SIMPSON, Passed Assistant Surgeon, United States Public Health Service.

Those contemplating the erection of a new or the repair of an old building, whether of frame, brick, rock, concrete, or other construction, should be informed as to the sanitary and economic benefits to be derived from rat-proofing measures of a permanent character, and should require the scrupulous application of such measures as a part of the builder's contract. The expense to be incurred is slight when compared with the cost of the building, and the measures applied will insure not only practical freedom from rats but in most cases freedom from various insects as well.

It is a popular fallacy that rats may be eliminated by poison and traps, whereas such measures used alone serve only to reduce their numbers, provide a greater abundance of food for survivors, and possibly stimulate multiplication. Neither trapping nor poisoning nor the combination of the two will alone rid premises of rats, for they breed four or five times a year, and although trapped or poisoned the birth rate keeps pace with the death rate.

For the successful elimination of the rat a third measure is absolutely essential, namely, the separation of the rat from his food supply. This will require in every instance certain structural alterations in buildings harboring them. After such changes have been effected, poison and traps become important adjuncts.

Commonly we have to deal with three varieties of rats: (1), the *Mus norvegicus*, known as the brown, gray, wharf or Norway rat; (2), the *Mus rattus*, the old English black rat; and (3), the *Mus alexandrinus*, the Egyptian or roof rat.

The brown rat (*M. norvegicus*) is larger than either the black or roof rat and more ferocious. He is a more prolific breeder and the young are more numerous. He is a burrower and usually makes his home in, or in close proximity to the ground, being most commonly found inhabiting ground areas of buildings, beneath the floors.[1] He is rarely trapped in upper stories. Under natural conditions, when unchecked by ratproofing measures, he destroys or drives to upper floors both black and roof rats. Only mice persist and occupy the same premises, their smaller size permitting escape into small holes. While known as the wharf rat, he is rarely trapped on ships visiting the Pacific coast.

Black and roof rats differ chiefly in color. They are of about the same size but smaller than the Norway rat. They show preference for upper floors and are able to live between ceilings, in walls, and on roofs. They are remarkable climbers, their agility permitting them to pass from roof to roof by telephone and electric wires or other means, and their great trap shyness and cunning render them more difficult of control than their larger relative.

In the presence of the unchecked Norway rat, comparatively few black or roof rats may be found, but when the larger rat is absent or has been destroyed they increase rapidly, and may then be found inhabiting basements and ground floors. They are generally acceded to be the most common ship-borne rat; they are by far the most common form trapped on ships visiting the Pacific coast from foreign ports.

These differences in the natural habitat being appreciated, it will be seen that any plan for the elimination of the rat must contemplate the rat proofing of the building from basement to roof.

For practical purposes, a rat-proof building may be defined as follows: A building constructed of material impervious to rats, in which all unnecessary or accidental openings have been permanently closed, and all natural openings provided with doors, windows, gratings, or screens closely approximating such openings, and securely closed when the building is not in use.

The rat can be built out and destroyed by the application of the following measures:

The erection of rat-proof buildings only.

The closure of all natural or accidental openings in existing buildings of rat-proof construction.

The remodeling of all nonrat-proof buildings, using materials impervious to rats.

The removal of material covering yards, sidewalks, and passageways which will permit rat refuge.

The protection or removal of rat food.

The destruction of rats by poison and traps.

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[1] The ground area is the space on which a building stands. The area wall is the wall inclosing such space.

THE RAT PROOFING OF THE NEW BUILDING.

FOUNDATION WALLS.

The building, if of frame construction, should be placed upon a foundation wall of material impervious to rats, such as brick or concrete. This wall should be not less than 6 inches in thickness; should be laid without break around the entire building; should extend not less than 18 inches beneath the surface of the surrounding soil and upward flush with the under surface of the floor above.[1] Floor joists should be embedded in this wall or the spaces between the joists filled in and perfectly closed, up to the floor level.

If the wall is opened to admit plumbing, the openings remaining around such plumbing should be at once closed with cement to the full depth of the wall. If the wall is opened to permit ventilation, such openings should be carefully screened with cast-iron gratings or wire cloth not less than 20 gauge nor greater than ½-inch mesh. If opened to admit basement doors, the doors must closely fit such openings when closed.

GROUND AREAS.

The ground area inclosed by foundation walls requires especial attention. If no food products are to be stored, prepared, or sold on the premises, the ground area should be covered with a layer of concrete not less than 3 inches in thickness, above which a floor of tongue-and-groove lumber should be placed, disregarding the dead space remaining between.

If the building is to be used as a fish market, bakery shop, sausage factory, candy factory, restaurant kitchen, or for the preparation of other foodstuffs, the ground area should be filled in with clean earth or sand to within 3 inches of the top of the foundation wall, over which should then be placed a layer of concrete not less than 3 inches in thickness, finished with a layer of cement not less than one-half inch in thickness. This surface, representing the floor of the building, should, for sanitary reasons, remain uncovered.

If the building is to be used as a bakery shop, meat market, butter shop, restaurant, delicatessen shop, or other place where foodstuffs are stored or kept for sale, the ground area preferably should be treated in a manner similar to that required where foodstuffs are prepared, a wooden floor, if desired, being closely laid over the concrete surface, care being used to see that no dead space sufficient to admit rats remains between the two. In lieu of this the ground area should be covered with a layer of concrete not less than 3 inches in thickness, and the floor above constructed of two layers of

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[1] It is important that the area wall extend not less than 18 inches beneath the surface soil; otherwise, rats will burrow under the walls and harbor beneath the building.

1-inch tongue-and-groove lumber driven tight, between which should be placed a layer of wire cloth not less than 20 gauge nor greater than one-half inch mesh. This wire cloth should extend upward 8 inches on the side walls and be covered with the baseboard.[1]

BASEMENTS.

Buildings provided with basements should have the side walls of such constructed of materials impervious to rats. The ground area—the basement floor—should be covered with concrete not less than 3 inches in thickness, finished with a wearing surface of cement not less than one-half inch in thickness.

Basement windows and basement ventilators should be carefully screened with wire cloth not less than 20 gauge nor greater than one-half inch mesh. Basement doors should fit snugly, and if practical should be provided with a liquid check or similar appliance which will automatically close them.

BASEMENT CEILINGS.

Wherever practicable and not prohibited by fire ordinance, basement ceilings should remain open and unsealed in order that rat refuge may be prevented between the basement ceiling and the floor above. If a finished ceiling is required such ceilings should be made and kept rat tight. Should the premises above such sealed basements be used for the storage, preparation, or sale of foodstuffs the floor above the basement ceiling should be constructed of two layers of 1-inch tongue-and-groove lumber driven tight, between which should be placed a layer of galvanized-iron wire cloth not less than 20 gauge nor greater than one-half inch mesh. This wire cloth should extend upward on the side walls not less than 8 inches and be covered with the baseboard.

Where the expense will not permit the installation of rat-proof foundation walls as described, rat proofing of frame structures (if not contrary to building laws) may be accomplished in a less satisfactory and less permanent way by elevation. In this case the building must be elevated on free underpinning, not less than 18 inches above the surface of the surrounding soil. It is important that the ground area beneath the elevated structure remain clean at all times and clear of lumber, boxes, and débris; otherwise a convenient and perfect harboring place for rats will be provided.

If the building is to be constructed of brick, stone, or concrete a foundation wall as outlined will of necessity be required to support the building. The same careful attention must be given to natural or unnecessary openings which may be made in the wall. Should chimney flues be carried by the wall from the basement to the roof and remain unused the openings should be closed with wire mesh or stopped with a close-fitting cover.

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[1] Experience teaches that ground areas should be concreted; otherwise rats escaping through accidental openings which may be subsequently made in the floor above will burrow and harbor in the ground beneath the building.

Side walls above the basement containing openings require little attention unless the building is in close proximity to adjacent structures or such openings convey electric or other wires, in which event the openings should be screened or kept closed.

THE ROOF.

Careful and successful rat proofing will require that all roof openings be given detailed attention. Doors and roof hatches should fit snugly and remain closed when not in use. Ventilators, skylights, and unused chimney flues should be screened with galvanized iron wire cloth not less than 20-gauge nor greater than one-half-inch mesh.

Upon the completion of the building a careful inspection should be made and any openings found sufficient in size to admit a rat should be at once closed. Such an inspection is also of particular importance following alterations or repairs and should under no circumstances be omitted if the building is to be maintained rat proof.

THE CLOSURE OF NATURAL OR ACCIDENTAL OPENINGS IN BUILDINGS OF RAT-PROOF CONSTRUCTION.

By rat-proof construction as used here is meant buildings covered with fireproof roofs and constructed with side walls and foundations of materials impervious to rats. Most city buildings of modern construction fall within this classification. Few are, however, actually rat proof. This is due partially to the omission of screens to basement windows and to ventilators, skylights, and other roof openings, but principally to the neglect of plumbers, electricians, and others to properly close openings around electric wires and pipes introduced for the conveyance of water, gas, or steam.

The closure of all such openings in buildings of this character is essential to perfect rat proofing; their discovery will require a painstaking inspection of the building from basement to roof.

This inspection should begin at the sidewalk. Sidewalk elevator doors and basement stairway doors should fit snugly; the latter should be provided with an automatic closing device. Basement windows, ventilators, and gratings should be screened with heavy wire cloth. Defects in the sidewalk should be repaired, and defective or absent lens lights in the sidewalks replaced.

Entering the basement, the floor should be noted, and if defective, repaired with concrete; otherwise such defective floor will permit burrowing and rat harbor beneath.

The side walls should next be inspected and all openings made for plumbing or electric or telephone wires carefully noted. Pipes for the water supply and house sewerage system rarely fit closely the openings in the wall made to permit their passage. Such jagged and irregular openings left by the careless plumber permit the easy entrance of rats and should be sealed with cement to the full depth of the wall.

Old, broken, and abandoned pipes previously used for water or sewage are occasionally found entering basement walls. They offer a convenient highway for rats between the basement and the street or sewer, and should be permanently stopped with cement.

Open conduits for the conveyance of electric cables may be frequently noted entering basement walls. Openings around and within such conduits should be closed with fine cement.

The lower ends of chimney flues entering the basement, if unused, should be screened. They frequently convey electric wires from the roof to the basement. Black and roof rats easily climb up and down these wires and in this way reach the roof or basement.

CEILINGS.

All defects or openings in basement ceilings should be perfectly closed. Such are likely to be found around pipes for gas, water, steam heat, or electric wires. If rats have found refuge between the ceiling and the floor above, this harborage can be most conveniently destroyed by the removal of the entire ceiling. If this is prohibited by fire ordinance every effort should be used to make and keep this ceiling and the floor above rat tight.

UPPER FLOORS.

On inspecting upper floors the same careful attention should be given to openings in partition walls made for the passage of pipes and wires. In addition attention should be directed toward inclosed dead space of sufficient size to permit rat refuge. Thorough rat proofing demands not only that the entrance of the rat to the building be prevented, but also that all contained rat harbors affording refuge be eliminated. Defects or breaks in walls should be repaired. Unfinished walls should be completed. Boxed toilet bases should be removed and solid foundations installed. Boxed plumbing should be opened up. Shelving and counters should contain no inclosed dead space. Food bins should be provided with close-fitting covers and be made rat tight. Dead space beneath show windows should be especially noted and opened up or be made rat proof by accurate construction. Accumulated rubbish should be removed, and boxed, crated, sacked or loose merchandise frequently inspected and moved to prevent even temporary rat harborage.

ROOFS.

The elimination of black and roof rats will depend upon the care used in closing roof openings. Roof hatches and doors in elevator houses should fit snugly and remain tightly closed when not in use. If constructed of wood they should be covered with heavy galvanized iron.

This is especially true when such buildings are occupied by stores or markets which store, prepare or keep food for sale, such as restaurants, bakeries, fish and meat markets, fruit and vegetable stores, delicatessen shops, candy factories, etc.

Skylight ventilators and louver[1] ventilators in elevator shafts should be screened with galvanized-iron wire cloth not less than No. 20 gauge nor greater than one-half inch mesh. Unused chimney flues should receive the same treatment, particular attention being given such openings when they admit electric or telephone wires.

THE REMODELING OF NONRATPROOF BUILDINGS.

This classification includes all frame structures, with or without basements and generally without foundation walls and floors impervious to rats. The majority of all buildings fall within this class, and since they permit the easy access of rats, supply food and afford refuge, they represent the principal obstacle to be overcome in the rat-proofing of cities or towns.

All such buildings should be remodeled and constructed with brick or concrete area walls, but, since the area wall to be provided in such cases is for rat-proofing purposes alone, the foundation wall of the structure need not be disturbed, the area wall being erected just within or without and against the old foundation. Preferably, this wall should be erected just within the old foundation. It should be constructed of brick, stone, or concrete, not less than 6 inches in thickness, should extend not less than 18 inches beneath the surface of the surrounding soil and upward until flush with the under surface of the floor above. Should the building rest upon a brick or concrete foundation, an additional wall will not be required, but care should be used to see that the foundation wall extends entirely around the building. Wherever lacking in this respect, or otherwise defective, it should be repaired. If floor joists rest upon the top of this wall, the wall should be continued upward between such joists until flush with the under surface of the floor above. All openings around pipes or wires should be sealed with cement.

The ground areas or basement floors of such structures and upper floors and roofs should be treated in the manner outlined for new buildings, particular care being used to see that the additional rat-proofing requirements are employed when such buildings contain foodstuffs.

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[1] A louver ventilator is an opening provided with slats having space between.

In rat proofing dwellings it should be known that the greatest number of rats can usually be caught under the front steps. This should be remembered when remodeling measures are applied.

THE REMOVAL OF MATERIAL COVERING YARDS, SIDEWALKS, AND PASSAGEWAYS.

Wooden floors, whether covering yards, sidewalks, or passageways, when lying in close proximity to the ground, offer easy access to rats and form a convenient harboring place. Such wooden floors should be removed and the ground area left bare or covered with gravel, cinders, or cement.

THE PROTECTION OR REMOVAL OF RAT FOOD.

By rat food is meant waste food or food refuse, such as is thrown carelessly on vacant lots, or around garbage cans, or into imperfect garbage cans, or surplus food thrown to chickens or dropped in transportation or handling.

The imperfect garbage can represents the most important source of rat food outside the building, and its contents provide amply for rat sustenance. Aside from other sanitary objections the elimination of the rat can not be accomplished until the imperfect garbage can has been replaced. The installation of a perfect garbage can is a civic necessity—a debt due the community by every householder, and this debt should be promptly paid.

Chicken yards offer a convenient source of rat food and should be rat proofed or abandoned. Rat proofing may be accomplished by constructing a coop or inclosure with an area wall as described for frame stuctures, the ground area being covered with 3 inches of concrete and the side walls above the foundation constructed of wire cloth not less than 20 gauge nor greater than ½-inch mesh. This should extend upward at least 6 feet. The door provided should be rat proof and remain closed when not in use. Chickens may range in the open yard, but should be fed only within the rat-proof coop.

THE DESTRUCTION OF RATS BY POISON AND TRAPS.

Poison and traps reduce the number of rats, but do not eliminate them. Both are of especial value in ridding large rat-proofed structures of contained rats, which, finding harbor and sustenance therein, might otherwise perpetuate themselves. Poison is of immense value in destroying rats on roofs and in localities presenting difficult or expensive rat-proofing problems, such as freight and storage depots, freight yards, garbage dumps, and the water front.

POISONS.

Most rat poisons depend upon phosphorus or arsenic for the poisonous element. Both act in a satisfactory manner and either, of good quality, may be purchased ready prepared in the open market. They should be spread upon bread cut into squares of about three-fourths inch, both sides being covered.

It is claimed that poisons containing phosphorus may occasion fires and that arsenical poisons, suffering but little deterioration on exposure, remain indefinitely dangerous to children or animals other than rats. Poisons should therefore be placed with great care. It is also important that the receptacle containing the stock supply be kept out of reach of children.

TRAPS.

Snap traps, because of their small size and adaptability, will be found most satisfactory for general use. They should be obtained with strong hardwood bases, all springs and wires being securely fastened to this base. The efficiency of such traps is increased when provided with a double-acting trigger release, with hooks for attaching bait. They should be placed where they will interrupt the runways of rats—under floors, above ceilings, within walls, and on girders, cross beams, ledges, etc. They should be securely anchored with a small piece of twine. Smoking is not essential.

Cage traps are of especial value in sewers, but may be employed in any position affording sufficient room. They may be covered with loose sacking or other material or left bare. Such traps should be about 20 inches long, with underbraces wired and the release pedal ledged. Mice can pass between the wires of cage rat traps, so that these traps when set may serve to supply mice with food. Cage-trapped rats should be chloroformed.

BAIT.

The various foodstuffs used for this purpose are here mentioned in the order of their relative value. For snap traps: Bacon, cheese, shelled nuts, scrap meat. For black rats: Dried raw meat. For cage traps: Bread (best dipped in grease), cheese, scrap meat, vegetables (cabbage, carrots).

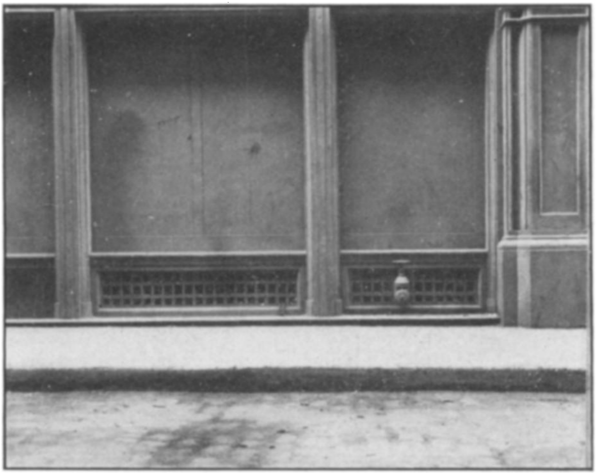

Fig. 1.—UNSCREENED BASEMENT VENTILATOR.

Rats enter basements from the street through such openings. They should be covered with wire-mesh screen.

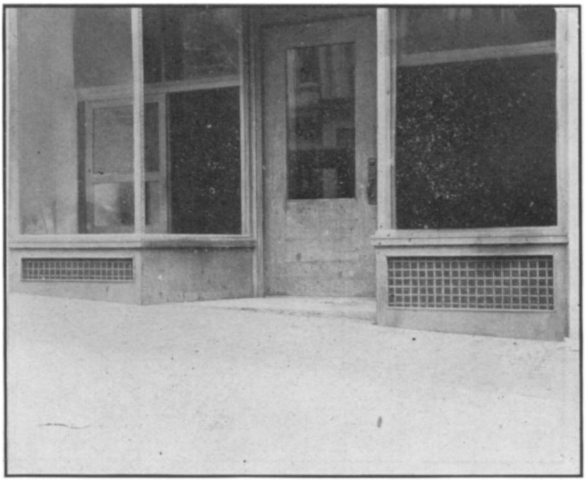

Fig. 2.—PROPERLY SCREENED BASEMENT VENTILATORS UNDER SHOW WINDOWS.

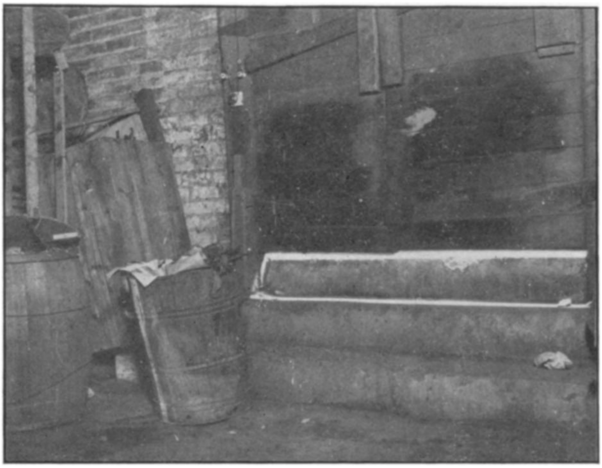

Fig. 3.—DEFECTIVE BASEMENT DOORWAY AT THE BOTTOM OF BASEMENT STAIRS.

Rats readily pass beneath such doorways to and from the street.

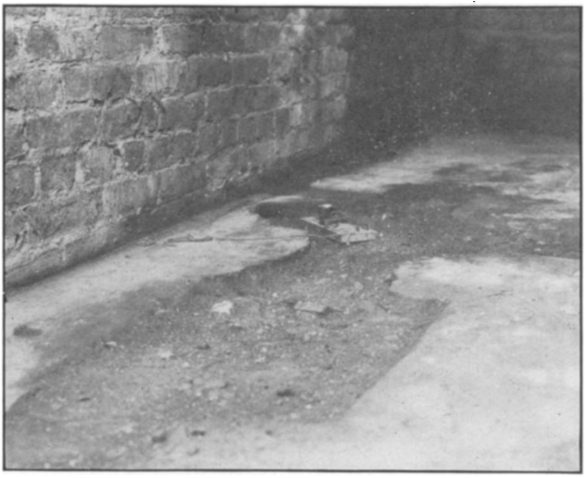

Fig. 4.—DEFECTIVE CONCRETE FLOOR IN BASEMENT, CONCRETE LAYER TOO THIN; HAS BECOME BROKEN AND NOW PERMITS BURROWING AND RAT HARBOR BENEATH.

All basement floors should be constructed of concrete not less than 3 inches thick and finished with a layer of cement one-half inch thick.

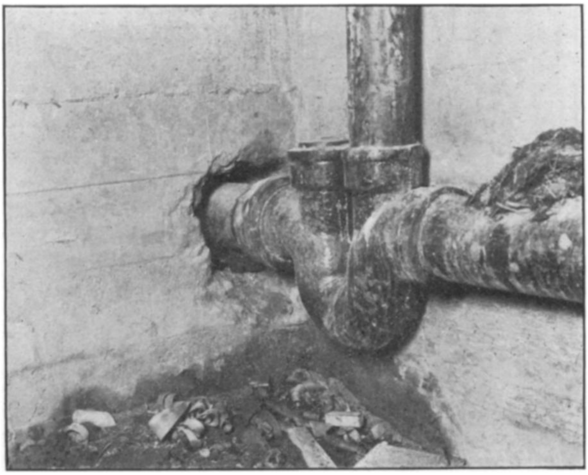

Fig. 5.—DEFECTIVE BASEMENT WALL. OPENING MADE FOR THE INSTALLATION OF HOUSE SEWAGE SYSTEM.

Opening left around sewer pipe and not subsequently closed. A convenient entrance for rats. Should be closed with cement.

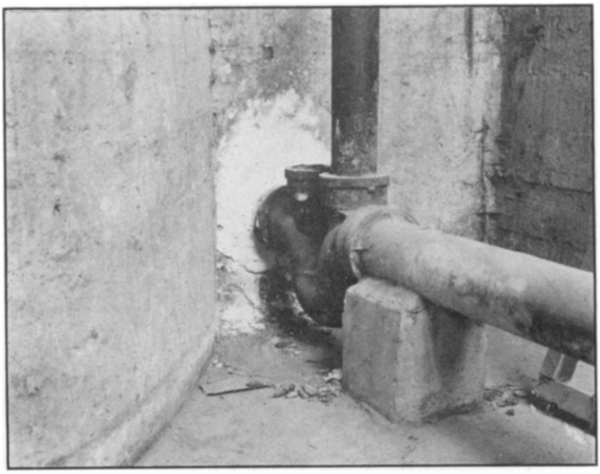

Fig. 6.—SHOWING PROPER REPAIR OF A DEFECTIVE WALL SURROUNDING SEWER PIPE ENTERING BASEMENT.

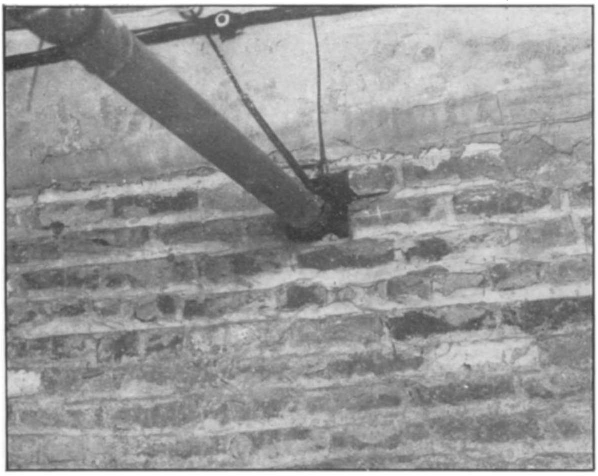

Fig. 7.—DEFECTIVE AND BROKEN WALL.

Entrance made for water pipes. Should be repaired with cement the full depth of the wall.

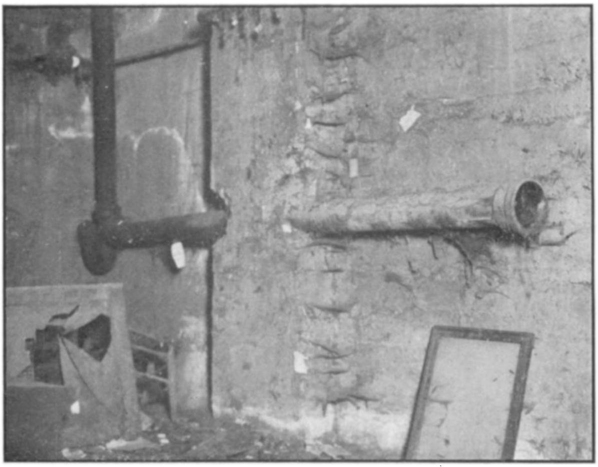

Fig. 8.—OLD ABANDONED SEWER ENTERING BASEMENT. A COMMON HIGHWAY FOR THE ENTRANCE OF RATS INTO BASEMENTS.

80 rats were trapped in the above sewer by placing a snap trap in the mouth of the opening.

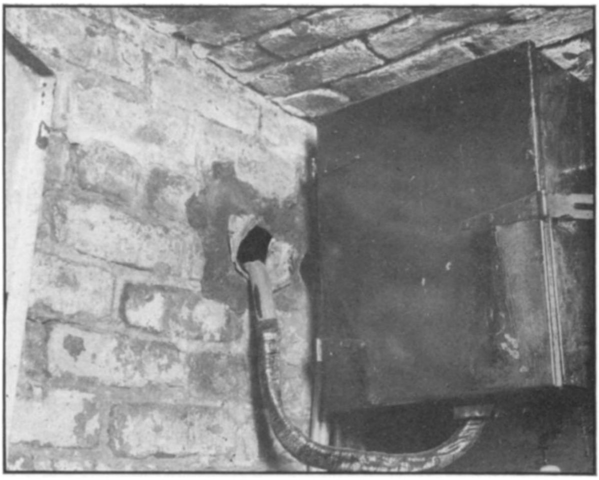

Fig. 9.—OPEN CONDUIT CARRYING ELECTRIC CABLE AND ENTERING BUILDING THROUGH BASEMENT WALL.

Such openings should be closed with fine cement the full depth of the wall.

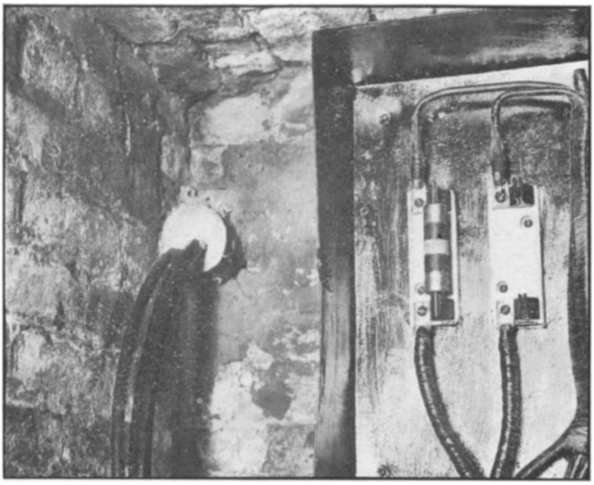

Fig. 10.—PROPERLY SEALED CONDUIT CARRYING ELECTRIC WIRES AND ENTERING THROUGH BASEMENT WALL. OPENINGS AROUND AND WITHIN CONDUIT SEALED WITH FINE CEMENT THE FULL DEPTH OF THE WALL.

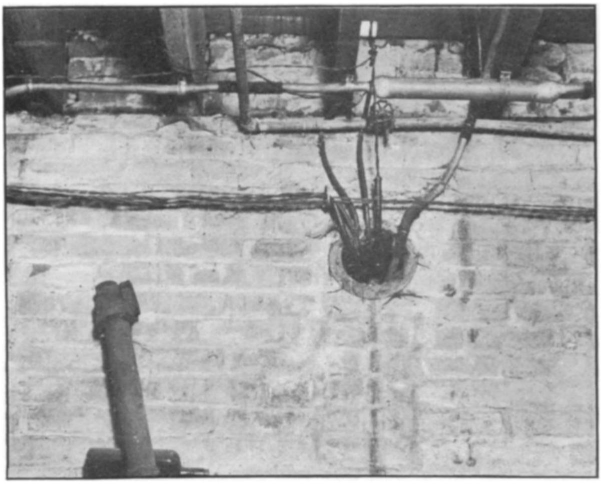

Fig. 11.—LOWER END OF CHIMNEY FLUE USED TO CONVEY ELECTRIC WIRES FROM THE ROOF TO THE BASEMENT.

Roof and Black rats readily climb up or down these wires and in this way reach the roof or the basement.

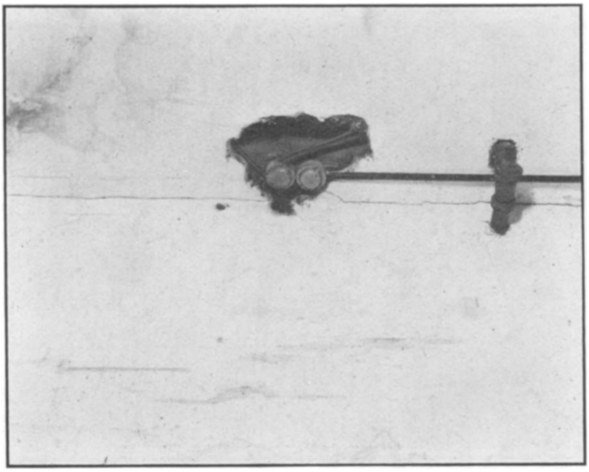

Fig. 12.—DEFECTIVE CEILING AROUND ELECTRIC WIRING.

Such openings permit rats to enter and harbor between the ceiling and the floor above. All openings in ceilings made for the installation of electric wires should be repaired promptly and perfectly.

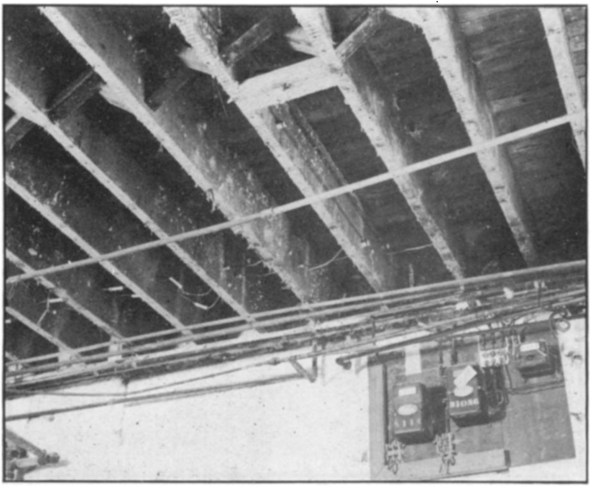

Fig. 13.—BASEMENT CEILING BEING REMOVED TO DESTROY RAT HARBOR EXISTING BETWEEN THE BASEMENT CEILING AND THE FLOOR ABOVE.

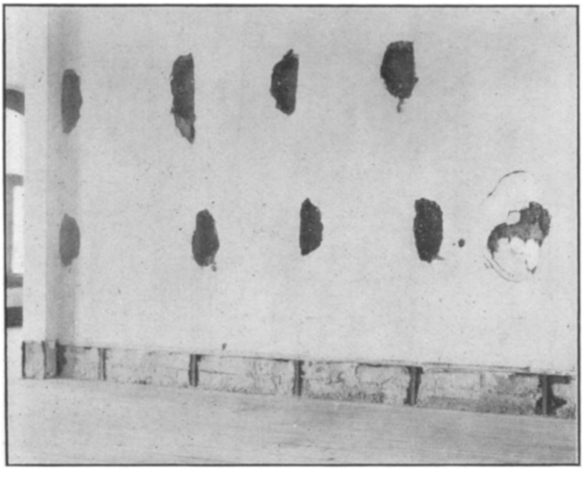

Fig. 14.—DEFECTIVE WALL IN LOFT OF BUILDING.

Damaged in removing fixtures when vacating premises and not subsequently repaired. Permits rats to enter and harbor between the walls.

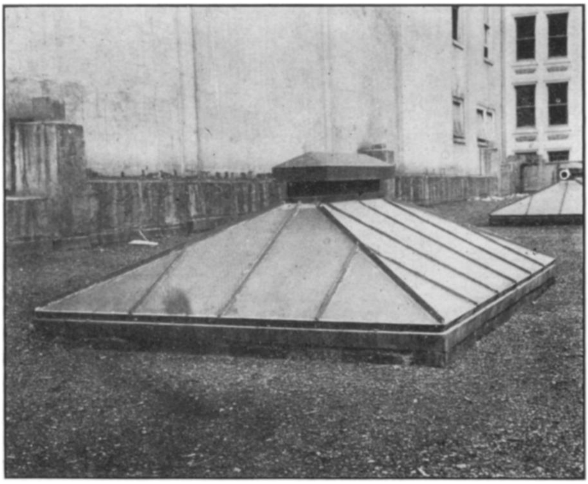

Fig. 15.—UNSCREENED SKYLIGHT VENTILATOR.

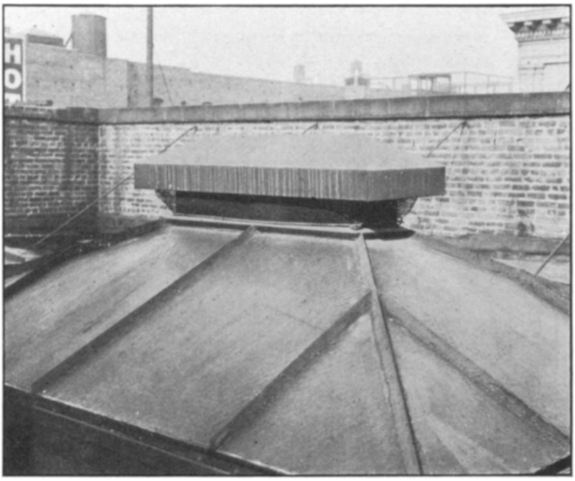

Fig. 16.—PROPERLY SCREENED SKYLIGHT VENTILATOR.

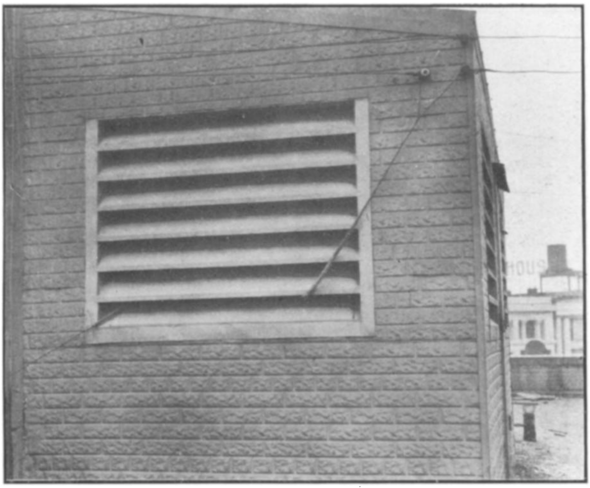

Fig. 17.—UNSCREENED LOUVER VENTILATOR IN ROOF OF ELEVATOR HOUSE.

Electric wires entering through such ventilators provide a runway and permit an easy means for the entrance of rats. All such ventilators should be screened.

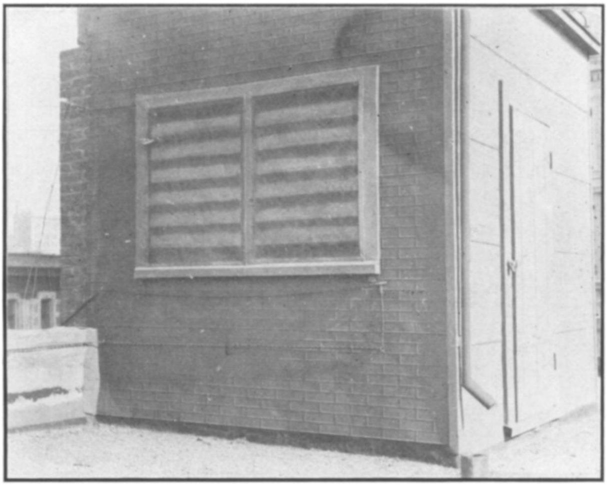

Fig. 18.—PROPERLY SCREENED LOUVER VENTILATOR IN ELEVATOR SHAFT HOUSING ON ROOF.

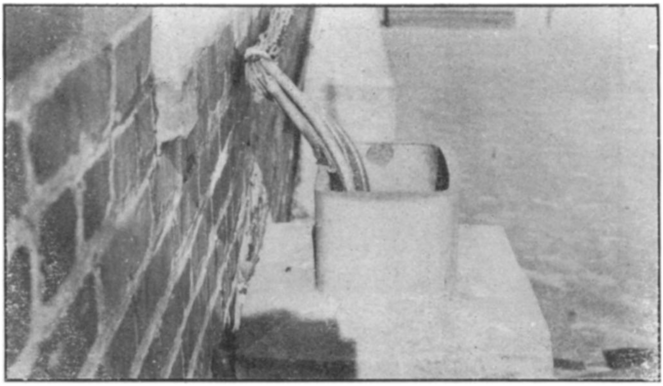

Fig. 19.—ROOF EXIT OF UNUSED, UNSCREENED, CHIMNEY FLUE, TRANSMITTING ELECTRIC CABLE FROM THE ROOF TO THE BASEMENT.

Roof and Black rats pass up or down such flues to reach the basement or roof. Such openings should be screened with heavy wire mesh.

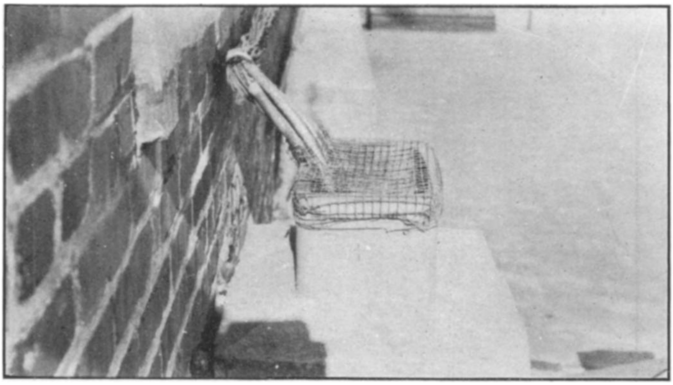

Fig. 20.—THE ROOF EXIT OF AN UNUSED CHIMNEY FLUE PROPERLY SCREENED WITH HEAVY WIRE MESH.